

Note: This document is incorporated by reference in California Code of Regulations, title 13, section 2208.2.

Draft Proposed California Certification and Installation Procedures for
Medium- and Heavy-Duty Vehicle Hybrid Conversion Systems

1. APPLICABILITY

- (a) "California Certification and Installation Procedures for Medium- and Heavy-Duty Vehicle Hybrid Conversion Systems (these procedures) apply to hybrid conversion systems designed for installation on the following non-hybrid base engines or vehicles:
1. 2007 and subsequent model year California-certified base vehicles between 6,001 to 8,500 pounds gross vehicle weight (GVW), where the conversion achieves at least 35 miles all-electric range (AER);
 2. 2007 and subsequent model year California-certified non-hybrid base vehicles between 8,501 to 14,000 pounds GVW; and
 3. 2010 and subsequent model year California-certified non-hybrid heavy-duty base engines and vehicles.
- (b) A certification of a hybrid conversion system issued pursuant to these procedures is to have the effect of a certification of a hybrid conversion system pursuant to Health and Safety Code section 43006. A certification for a hybrid conversion system issued pursuant to these procedures is to have the effect of an exemption issued pursuant to Vehicle Code Section 27156.

2. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

These procedures incorporate by reference the definitions and abbreviations set forth in California's Innovative Technology Regulation as set forth in California Code of Regulations, title 13, section 2208, and 40 Code of Federal Regulations (C.F.R.), Part 1065 (Engine Testing Procedures), unless otherwise amended below.

- (a) "55 Mile Per Hour (mph) Cruise Cycle" means the procedure described in 40 C.F.R., Part 1037.510 (a).
- (b) "Average Driving Speed" means the distance traveled divided by the cycle time, excluding the time during which the vehicle operates at zero miles per hour.
- (c) "Authorized Installer" means any individual or entity that equips any vehicle or engine with a hybrid conversion system and has the authorization of the party that

holds the ARB Executive Order for the hybrid conversion system pursuant to Section 9 of these procedures.

- (d) "Base engine" means a California-certified configuration of a motor vehicle engine prior to any modifications necessary for the engine to operate as a hybrid.
- (e) "Base vehicle" means a California-certified configuration of a motor vehicle prior to any modifications necessary for the vehicle to operate as a hybrid.
- (f) "Class 2a vehicle" means an on-road motor vehicle of between 6,001 and 8,500 pounds gross vehicle weight rating (GVWR).
- (g) "Coefficient of Variation" or "CoV" for a data set is the normalized measure of the dispersion of a probability distribution, calculated as the ratio of the standard deviation to the mean.
- (h) "Conversion system manufacturer" or "converter" means a person or entity which manufactures or assembles a hybrid conversion system for sale in California.
- (i) "Drivability" means the smooth delivery of sufficient and reliable power for the intended vehicle type and duty cycle, as demanded by the driver.
- (j) "Engine automatic stop-start system" means a mechanism that automatically turns off the internal combustion engine when the vehicle is stopped, such as at a traffic light, and restarts when the vehicle operator pushes the accelerator.
- (k) "Federal Test Procedure" or "FTP-75" means the test procedure as described in C.F.R., Part 86.130-00 (a) through (d) and (f).
- (l) "Hybrid conversion system" is a package of energy storage and delivery, ignition, emission control, on-board diagnostics (OBD), and engine components that are modified, removed, or added during the process of modifying a base engine or vehicle to operate as a hybrid.
- (m) "Orange County Bus Cycle" means the procedure described in Appendix C of ARB's *Staff Report: Initial Statement of Reasons – Proposed Modifications to the Public Transit Fleet Rule and Interim Certification Procedures for Hybrid Electric Urban Transit Buses*; September 6, 2002; <http://www.arb.ca.gov/regact/bus02/appc.pdf>.
- (n) "Positive Kinetic Energy" or "PKE" means $(1/\text{total distance}) * \sum[(\text{velocity}(i))^2 - (\text{velocity}(i-1))^2]$, in feet/second², for velocity data collected on the interval of $i = 1$ to n number of time samples, evaluated on a one Hertz basis.
- (o) "Transient Portion of the Heavy Heavy-Duty Truck 5 Mode Cycle" means the test cycle specified in 40 C.F.R., Part 1037, Appendix I.

- (p) “Useful life” for purposes of these procedures, means the duration, expressed in miles or time period, of the longest regulatory durability period for the new vehicle or engine emission standards to which the base vehicle or engine was certified.
- (q) “Valid warranty claim” means a request from an end user, authorized installer, or distributor to the applicant for an inspection, repair, adjustment, replacement, or modification of a specific part or component of the hybrid conversion system or the base engine or vehicle, for which the hybrid system converter is invoiced for compensation pursuant to the warranty provisions, and compensation is actually provided, excluding warranty repairs made solely for customer satisfaction purposes (i.e., good faith repairs).
- (r) “Warrantable condition” means any condition of a hybrid conversion system or base engine that triggers the responsibility of the conversion system manufacturer or authorized installer to take corrective action.
- (s) “Warranted part” means any part installed on a hybrid conversion system, or part installed during a hybrid conversion system warranty repair, which affects any regulated emissions from a previously-certified vehicle test group or engine family.
- (t) “Warranty period” means the period of time, mileage, and/or hours, as identified in Section 10, Table 1 of these procedures, that the certified hybrid conversion system or part thereof are covered by the warranty provisions.
- (u) “Zero-emission power take-off” or “electric power take-off” (ePTO) means a method for taking power from an on-vehicle source (typically a battery) that produces no emissions of regulated pollutants and which can be used to power a non-vehicular device that is permanently connected to the vehicle.
- (v) “Z-score” means the number of standard deviations an observation is from the mean. It is calculated as $z = (x - \mu) / \sigma$, where x is the observed value, μ is the mean of the population, and σ is the standard deviation of the population.

3. GENERAL REQUIREMENTS

In addition to all other standards or requirements imposed by these procedures, the following general requirements shall apply:

(a) Emission Performance Criteria:

- (1) The hybrid conversion system must achieve at least a ten percent carbon dioxide (CO₂) emission reduction and not increase oxides of nitrogen (NO_x), hydrocarbons (HC), carbon monoxide (CO) or particulate matter (PM) exhaust emissions, and must not increase evaporative emissions, when

installed and operated on vehicles and engines belonging to proposed base vehicle test groups and engine families.

- (2) The Executive Officer may conduct independent emission testing to evaluate whether a hybrid conversion system meets the emission or other criteria of these procedures. If such testing demonstrates that the hybrid conversion system fails emission or other eligibility criteria of these procedures, the Executive Order for the hybrid conversion system may be revoked, and the Executive Officer may, at his/her discretion, initiate recall proceedings pursuant to Section 11 of these procedures. Further, if such tests or other evidence provides ARB with reason to suspect that the hybrid conversion system will adversely affect durability of the vehicle emission control system, the manufacturer must, within 30 days of notice, or another mutually agreed upon date, submit durability data, in a format to be determined by the Executive Officer, demonstrating that the durability of the vehicle emission control system is not affected.
- (3) No component or calibration of the hybrid conversion system that could affect emission performance may be adjustable by the authorized installer or the vehicle user.

(b) Emission Control Labels:

The emissions control label requirements in Title 13, California Code of Regulations, title 13, section 1965, apply to hybrid conversion systems, with the following additions:

- (1) The hybrid conversion system manufacturer must provide a durable and legible supplemental Emission Control Information Label, which must be affixed in a permanent manner to each converted vehicle in a location where it can be seen by a person viewing the original Emission Control Information Label, and , where possible, it must be placed in a location where it can be seen by a person viewing the Emission Control Information Label. The label and any adhesives used must be designed to withstand, for the converted vehicle or engine's useful life, environmental conditions in the area where the label is attached. Environmental conditions must include, but are not limited to, exposure to engine fuels, lubricants, and coolants.
- (2) The supplemental label must show the following:
 - (A) Vehicle Information: The base vehicle or engine model year, as applicable; the hybrid conversion system Executive Order number; the hybrid conversion system manufacturer name, address and telephone number; a manufacturer statement that the converted vehicle or engine complies with California emission requirements; and a list of any parts that

were added or removed during installation of the hybrid conversion system, as well as any changes in tune-up specifications required for the hybrid conversion system;

(B) Installation Information: The hybrid conversion system authorized installer(s) name, address, and telephone number; the date of installation; and the installation mileage (i.e., converted vehicle odometer reading taken on the date the hybrid conversion system was installed); and

(C) Warranty Information: The warranty expiration date and the warranty expiration mileage (i.e., the mileage at which the hybrid conversion system warranty expires).

(c) Drivability:

The drivability of a vehicle equipped with a hybrid conversion system must not be degraded in such a way as to encourage consumer tampering or create a safety hazard. The Executive Officer's determination about whether drivability is acceptable must be based on an engineering evaluation of the hybrid conversion system described in the application for certification or on reports or observations that a hybrid conversion system similar in design to the system for which certification is sought have caused drivability degradation. To verify that the drivability of a converted vehicle is acceptable, the Executive Officer may require that an independent laboratory evaluate drivability. The cost of this evaluation shall be borne by the applicant.

(d) Anti-Backsliding:

Notwithstanding the provisions of these procedures, the Executive Officer reserves the right to require a hybrid conversion system to meet more stringent emissions compliance, diagnostics, warranty, and other requirements if the hybrid conversion system is subject to such requirements by U.S. EPA at the time the manufacturer applies to ARB for hybrid conversion system certification.

(e) Owner's Manual:

The manufacturer must provide to the purchaser an owner's manual containing at least the following information for each hybrid conversion system installed:

- (1) A brief description of the hybrid conversion system, including major components and their theory of operation, and proper operation of the hybrid system;
- (2) Battery maintenance best practices and charging procedures and protocols for the hybrid conversion system, if applicable;

- (3) A listing of necessary service and service intervals, as well as tune-up data, which differ from the service requirements specified by the base vehicle's or engine's original manufacturer;
 - (4) An indication that the converted vehicle is subject to all in-use vehicle inspection and maintenance programs applicable to its size, type and class. Owner's manuals for gasoline-powered vehicles and for vehicles below 14,000 lbs. GVW must indicate the vehicle is subject to California Smog Check at a Smog Check Referee Center;
 - (5) The name, physical address, e-mail address, phone number, and website, if available, of the conversion system manufacturer and authorized installer(s), as well as a list of the names, addresses, and phone numbers of the major dealers in California who supply parts for, or service, the hybrid conversion system;
 - (6) All information necessary for the proper and safe operation of the converted vehicle, including information on the safe handling of the battery system, and emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator, emergency personnel, or laboratory personnel; and
 - (7) The product warranty statement required pursuant to Section 10(c) of these procedures.
- (f) Installation:

The hybrid conversion system manufacturer must provide its authorized installer(s) with specific, written instructions and training regarding installation procedures for its conversion systems, as needed to comply with the diagnostics, labeling, and other requirements of these procedures. The manufacturer must have a written contractual relationship with its hybrid conversion system authorized installer(s). A copy of said written contract and installation procedures must be provided by the manufacturer to ARB within thirty days upon request.

(g) Funding Program Disclosure Requirements:

When applying for public incentive funding for a Tier 1 or Tier 2 certified hybrid conversion system, the conversion system manufacturer must disclose, in writing as part of the funding application to the potential funding entity, the current level of ARB hybrid conversion system certification (Tier 1 or Tier 2) and the applicable California sales limits identified in that certification for the hybrid conversion system. Such disclosure must indicate whether requested incentive funding is intended to fund a volume of hybrid conversion systems that is allowed by the current ARB certification pursuant to these procedures, or a volume that

cumulatively would exceed what is allowed by the current ARB certification pursuant to these procedures.

(h) Battery Disposal:

The manufacturer must provide written information regarding proper disposal of the hybrid vehicle battery to dealers and purchasers of the hybrid conversion systems, and provide a copy of this written information to ARB, along with a description of how this information is conveyed, as part of its hybrid conversion system certification application.

4. TIER 1 CERTIFICATION REQUIREMENTS

(a) Tier 1 Emission Compliance.

- (1) Exhaust Emissions. A manufacturer must provide an engineering evaluation demonstrating that its proposed hybrid conversion system, when properly installed on the proposed base engine(s) or vehicle(s), will result in at least a 10 percent CO₂ emission reduction and not increase emissions of NO_x, HC, CO or PM relative to the pre-converted engine or vehicle configuration. The Executive Officer shall evaluate said demonstration for approval based upon his or her engineering judgement regarding data and other information provided by the manufacturer, including engine or vehicle certification data, and other pertinent information regarding the operating principles of the base engine(s) or vehicle(s) and proposed hybrid conversion system.
- (2) Evaporative Emissions. A hybrid conversion system must demonstrate that it will not increase evaporative emissions from the base engine or vehicle, as follows:
 - (A) Light- and Medium-Duty Vehicle Conversions. A manufacturer of a hybrid conversion system for a base vehicle of between 6,001 and 14,000 lbs. GVW must demonstrate that the converted vehicle meets the evaporative emissions standard to which the base engine or vehicle was originally certified, by conducting the two-day diurnal evaporative procedure emissions test as specified in the "*California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Motor Vehicles*," amended on December 6, 2012, and incorporated by reference herein;
 - (B) Heavy-Duty Engine Conversions. A manufacturer of a hybrid conversion system for a base vehicle of 14,001 lbs. or greater GVW must provide an engineering evaluation demonstrating that the conversion system does not increase evaporative emissions from the base vehicle in lieu of the two-day diurnal evaporative procedure emissions test. The Executive Officer shall evaluate said demonstration based upon data and other information provided by the manufacturer, including engine certification data, and his or her

engineering evaluation of whether the hybrid system's operational characteristics are likely to increase the number of cold-starts during typical operation; and

- (C) Compression-ignition Engines and Sealed Fuel Systems. A converted vehicle with a compression ignition engine or a sealed fuel system that can demonstrate no evaporative emissions is exempt from evaporative emissions testing. This demonstration may be based upon an engineering evaluation of the base vehicle and hybrid conversion system and data submitted by the conversion system manufacturer, and must indicate that the converted vehicle has no evaporative-related emissions under normal operation. Any such demonstration must be approved by the Executive Officer in order for the converted vehicle to be exempt from evaporative emission testing.
- (b) For hybrid conversion systems that achieve less than 35 miles AER and meet the minimum eligibility requirements of Sections 3 and 4 of these procedures, a manufacturer may receive Tier 1 Executive Orders authorizing installation and California sale of a total of 10 units.
- (1) A manufacturer is ineligible to submit an application for Tier 1 certification of a hybrid conversion system that achieves less than 35 miles AER as of January 1, 2022.
- (2) Tier 1 Executive Orders for hybrid conversion systems that achieve less than 35 miles AER expire as of January 1, 2027, and additional units of a hybrid conversion system authorized pursuant to such an Executive Order may not be installed or sold after January 1, 2027.
- (c) For hybrid conversion systems that achieve at least 35 miles AER and meet the minimum eligibility requirements of Sections 3 and 4 of these procedures, a manufacturer may receive Tier 1 Executive Orders authorizing installation and California sale of a total of 25 units.
- (1) A manufacturer is ineligible to submit an application for Tier 1 certification of a hybrid conversion system that achieves at least 35 miles AER as of January 1, 2025.
- (2) Tier 1 Executive Orders for hybrid conversion systems that achieve at least 35 miles AER expire as of January 1, 2030, and additional units of Tier 1 certified hybrid conversion systems may not be installed or sold after January 1, 2030.
- (d) Reporting Requirements. A manufacturer must collect the following information, which must be current as of the hybrid conversion system installation date, regarding each unit sold of a Tier 1 or Tier 2 certified hybrid conversion system.

This information must be kept for at least calendar five years from the hybrid conversion system's installation date and must be provided to the Executive Officer within thirty days upon request:

- (1) Vehicle make, model, model year, identification number (VIN), and California license plate number;
 - (2) Vehicle owner's physical address, e-mail address, and phone number, and whether they are personal or business;
 - (3) Vehicle operator's name and physical address (if different than the vehicle owner, and whether they are personal or business;
 - (4) Conversion system authorized installer name, physical address, e-mail address, and phone number, and whether they are personal or business;
 - (5) Location, date, and odometer reading at time of hybrid conversion system installation; and
 - (6) ARB certification Tier (i.e., Tier 1 or 2).
- (e) Tier 1 On-Board Diagnostics Requirements. If the base vehicle or engine to be converted was originally certified with an OBD system pursuant to California Code of Regulations, title 13, section 1968.2 or 1971.1, respectively, all OBD requirements remain applicable to the base engine or vehicle, with the exception of the provisions described in Section 4(e)(1) through (e)(5) of these procedures, below. As such, the proper function of the OBD system must not be impaired as a result of the installation and operation of the hybrid conversion system. This includes, but is not limited to, ensuring the converted vehicle's or engine's OBD system robustly detects malfunctions at the required emission thresholds, implements required monitors for applicable added or modified electronic hardware or emission controls, complies with standardization requirements, and is subject to required demonstration and production vehicle and engine testing. These requirements may necessitate modification of the original vehicle or engine OBD system. All modifications affecting OBD compliance, including added, modified, or removed original vehicle hardware (e.g., components, wiring) or software (e.g., programming, calibration) must be fully documented and described as part of the hybrid conversion system certification application.
- (1) Monitoring Requirements. For all converted engines or vehicles, the manufacturer is required to implement an EMD system on the hybrid system that meets the requirements described in California Code of Regulations, title 13, section 1971.1, subdivision (d)(7.1.4), incorporated by reference herein.

- (2) Hybrid System Diagnostic Link Connector (HSDLC). If the converted engine or vehicle includes a dedicated HSDLC to communicate with the hybrid diagnostic system, the HSDLC must be distinguished from the base engine's or vehicle's OBD system DLC by locating the HSDLC in the vehicle interior to the right of the centerline of the vehicle.
- (3) Monitoring Conditions. A 2013 or subsequent model year heavy-duty engine conversion certified pursuant to these procedures to an IUMPR of 0.100 in accordance with California Code of Regulations, title 13, section 1971.1, subdivision (d)(3.2.2) shall not be considered nonconforming if the data collected from the engine in the test sample group indicate that the average in-use monitoring performance ratio for one or more of the monitors in the test sample group is less than 0.100. Similarly, a 2007 or subsequent model year light- or medium-duty vehicle conversion certified to an in-use monitoring performance ratio specified in California Code of Regulations, title 13, section 1968.2, subdivision (d)(3.2) shall not be considered non-conforming if the data collected from the engine or vehicle is less than the specified level of California Code of Regulations, title 13, section 1968.2, subdivision (d)(3.2).
- (4) Modifications to the Base Engine, Base Engine's OBD System, or Base Engine or Vehicle Aftertreatment System. Any modifications that are made as part of the aftermarket conversion to a previously-certified HD OBD or OBD II certified engine's or vehicle's OBD system, engine or aftertreatment system requires revalidating the impacted system and the affected monitors' performance. Any modifications made to the base engine's or vehicle's certified OBD system may only be made for the purpose of preventing false malfunction determinations that could otherwise occur as a result of the integration of the hybrid system hardware and software, and such modifications may only be made to the extent necessary to achieve this purpose or to ensure that the certified base engine or vehicle's OBD system is still capable of detecting when the base engine or vehicle's monitored systems have a total lack of function. All modifications are subject to Executive Officer approval. The Executive Officer may grant approval upon the manufacturer demonstrating that the modifications do not make the base engine's or vehicle's OBD system more susceptible to false malfunction determinations and do not prevent the certified base engine or vehicle's OBD system from detecting when the base engine or vehicle's monitored systems and components have a total lack of function. The revalidation testing must be similar in scope to the verification of monitoring requirements described in California Code of Regulations, title 13, section 1971.1, subdivision (l)(2) for heavy-duty engines and California Code of Regulations, title 13, section 1968.2 for light- and medium-duty engines or vehicles. Emission test data are not required. Before conducting validation testing, manufacturers must submit a plan to the Executive Officer for review and approval that details the

monitors to be tested, the test vehicle description, the testing methodology, the timeline to collect the data, and the reporting format.

- (5) Production Engine/Vehicle Evaluation Testing Verification of Standardized Requirements: The hybrid conversion manufacturer must conduct and report testing as described in California Code of Regulations, title 13, section 1971.1, subdivision (l)(1) for heavy-duty engines and California Code of Regulations, title 13, section 1968.2, subdivision (j)(1) for light- and medium-duty vehicles, with the exception of section 1968.2, subdivisions (c)(3)(D)5.a. and (c)(3)(D)5.b.

(A) Test Vehicle Selection Criteria. In lieu of the test vehicle selection criteria specified in California Code of Regulations, title 13, section 1971.1, subdivisions (1.2.1) through (1.2.3) for heavy-duty engines, the manufacturer must test at least one of each base vehicle and hybrid conversion system combination certified pursuant to Section 4 of these procedures.

(B) The testing and reporting of the test results must be completed and submitted to ARB before approval can be granted.

5. TIER 2 CERTIFICATION REQUIREMENTS

- (a) Tier 2 Emission Compliance. In order to receive a Tier 2 Executive Order, a hybrid conversion system must demonstrate at least a ten percent CO₂ reduction and no increase in NO_x, HC, CO, or PM emissions pursuant to Section 7 of these procedures and no increase in evaporative emissions pursuant to Section 4(a) of these procedures.
- (b) A manufacturer may receive Tier 2 Executive Orders authorizing installation and California sale of a total of 500 units, not including the ten units authorized for sale pursuant to a Tier 1 Executive Orders, for hybrid conversion systems that achieve less than 35 miles AER and have been demonstrated to meet the requirements of Sections 3 and 5 of these procedures.
- (1) A manufacturer is ineligible to apply for Tier 2 certification of a hybrid conversion system that does not achieve at least 35 miles AER as of January 1, 2022.
- (2) Tier 2 Executive Orders for hybrid conversion systems that do not achieve at least 35 miles AER expire as of January 1, 2027, and additional units of such systems may not be installed or sold after January 1, 2027.
- (c) A manufacturer may receive Tier 2 Executive Orders authorizing installation and California sale of a total of 1,000 units, not including the 25 units authorized for

sale pursuant to Tier 1 Executive Orders, for hybrid conversion systems that achieve at least 35 miles AER and has been demonstrated to meet the requirements of Sections 3 and 5 of these procedures.

- (1) A manufacturer is ineligible to apply for Tier 2 certification of a hybrid conversion system that achieves at least 35 miles AER as of January 1, 2025.
- (2) Tier 2 Executive Orders for hybrid conversion systems that achieve at least 35 miles AER expire as of January 1, 2030, and additional units of such systems may not be installed or sold after January 1, 2030.
- (d) A hybrid conversion system is not required to have received a Tier 1 Executive Order to being eligible for a Tier 2 Executive Order, as long as the system meets the Tier 2 certification requirements these procedures.
- (e) Reporting Requirements. A manufacturer must collect the information required of Tier 2 certified systems pursuant to Section 4(d) of these procedures, and an application for Tier 2 certification of a hybrid conversion system must include the information identified in Section 4(d) of these procedures for each of its Tier 1 certified hybrid conversion systems sold or leased in California as of 90 days prior to the Tier 2 application submittal date.
- (f) Tier 2 On-Board Diagnostics Requirements. For a Tier 2-certified hybrid conversion system, the manufacturer must comply with all the Tier 1 OBD requirements set forth in Section 4(e) of these procedures and the following requirements.
 - (1) Monitoring Conditions. In addition to the monitoring conditions set forth in Section 4(e)(3) of these procedures, the conversion system manufacturer is required to investigate the cause for IUMPR performance that does not meet the required IUMPR specified in California Code of Regulations, title 13, section 1968.2, subdivision (d)(3.2) for light- and medium-duty vehicles or engines and California Code of Regulations, title 13, section 1971.1, subdivision (d)(3.2.2) for heavy-duty engines, and develop a plan to improve the IUMPR performance to meet the required IUMPRs in time for Tier 3 certification. A report detailing the issue and describing the IUMPR improvement plan must be submitted to ARB within one year after ARB certification of the hybrid conversion system;
 - (2) OBD System Readiness Status Demonstration. In accordance with Society of Automotive Engineers (SAE) J1979/J1939-73 specifications, a manufacturer must demonstrate for all heavy-duty engine families that the OBD system can be set to “complete” with no false detections of malfunctions since the fault memory was last cleared for each of the installed monitored components and systems identified in California Code of Regulations, title 13,

section 1971.1, subdivisions (e)(1) through (f)(9), except subdivisions (e)(11), (f)(4), and (g)(3). Similarly, a manufacturer must demonstrate for all light- and medium-duty vehicles that the OBD system can be set to “complete” with no false detections of malfunctions since the fault memory was last cleared for each of the installed monitored components and systems identified in California Code of Regulations, title 13, section 1968.2, subdivisions (e)(1) through (e)(8), (e)(13), (e)(15), (f)(1) through (f)(9), (f)(13), and (f)(15);

- (3) Modifications to the Base Engine’s OBD System. The requirement for modifications to the base engine’s OBD system set forth in Section 4(d)(4) of these procedures applies, except that hybrid conversion systems being carried over from a previously approved Tier 1 system are exempt from further revalidation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1 approved system and vehicle, and the manufacturer attests in the conversion system’s Tier 2 certification application that the diagnostic system and vehicle are unchanged;
- (4) Monitoring System Demonstration Requirements. OBD system demonstration requirements, described in California Code of Regulations, title 13, section 1971.1, subdivision (i) for heavy-duty engines and California Code of Regulations, title 13, section 1968.2, subdivision (h) for light- and medium-duty engines and vehicles, are applicable except for the following allowances:
 - (A) Number and Selection of Test Engines or Vehicles. The selection of test engines or vehicles must be based on the criteria described in subsection III.A. through B. of the “*Procedures for Exemption of Add on and Modified Parts*,” amended June 1, 1990, and incorporated by reference herein;
 - (B) Monitors Required for Testing. To the extent feasible, hybrid conversion system manufacturers must demonstrate a maximum of three major monitors that are subject to the OBD system demonstration testing requirements of California Code of Regulations, title 13, section 1971.1, subdivisions (i)(3) and (i)(4) or California Code of Regulations, title 13, section 1968.2, subdivisions (h)(3) and (h)(4). The monitors to be tested shall be selected by the Executive Officer after the conversion system manufacturer has completed its allotment of Tier 1 vehicles or by the date in which the Tier 2 certification application is submitted, whichever comes first, and must follow the testing protocol in Section 5(f)(4)(C) of these procedures, below; and
 - (C) Testing Protocol. Prior to conducting the demonstration test, conversion manufacturers must submit a test plan to the Executive Officer for review and approval that specifies the types and number of converted vehicles to be tested; the test procedures, including the pre-conditioning cycles, test cycles and fault implantation method; the implanted malfunction

description (e.g., empty catalyst can); the timeline to collect the data; and the reporting format in which the manufacturer will submit a plan for providing emission test data to the Executive Officer for approval. The manufacturer may not begin testing until the Executive Officer approves the test plan. Once the manufacturer receives Executive Officer approval of the test plan, testing may begin with the following steps:

- (i) Clear OBD Information: The OBD information must be cleared prior to implanting the threshold for each monitor to be demonstrated.
- (ii) Threshold Part: The threshold part for demonstrating the monitor must be implanted prior to demonstration testing. The threshold part developed for the demonstration must be representative of a part that has deteriorated to a point where it has minimal or no ability to perform its intended function (e.g., a total restriction of the EGR valve when demonstrating EGR flow functionality).
- (iii) Drive Cycles: The demonstration for heavy-duty vehicles may be conducted either over the road or on a chassis dynamometer. Demonstration on a chassis dynamometer must be performed on either the heavy-duty vehicle urban dynamometer driving schedule (UDDS) (40 C.F.R., Part 86, Appendix I(a)) or on the heavy duty transient test cycle (40 C.F.R., Part 1037, Appendix I). Demonstration for medium-duty vehicles on a chassis dynamometer will be performed on the urban dynamometer driving schedule (UDDS) (40 CFR, Part 86 Appendix I (a). Manufacturers may request Executive Officer approval to utilize a different chassis dynamometer cycle for demonstration testing. In evaluating the manufacturer's request, the Executive Officer shall consider the degree to which a drive cycle reflects the anticipated duty cycle of the converted vehicle. Emission measurements are not required. The route used for on-road testing must be provided in the test report.
- (iv) Evaluation Protocol: The demonstration testing must continue until the fault code associated with the malfunction is stored and the malfunction indicator light (MIL) illuminated. Multiple drive cycles may be necessary to illuminate the MIL.
- (v) Test Data Collection: OBD system data for each monitor demonstration must be recorded after each drive cycle and provided to ARB with a report summarizing the results of the demonstration testing. The report must be submitted by the conversion manufacturer and approved by ARB to receive Tier 2 approval. For heavy-duty vehicle conversions, data requirements are described in California Code of Regulations, title 13, section 1971.1, subdivision

(i)(4.3). For light- and medium-duty vehicle conversions, data requirements are described in California Code of Regulations, title 13, section 1968.2, subdivision (h)(5.3).

- (5) Production Engine or Vehicle Evaluation Testing. The production evaluation testing described in California Code of Regulations, title 13, 1971.1, subsections (l)(1) and (l)(3) and California Code of Regulations, title 13, 1968.2, subsections (j)(1) and (j)(3) is required to be revalidated for Tier 2 approval. Systems that are being carried over from a previously approved Tier 1 system are exempt from further production engine or vehicle evaluation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1 approved system and vehicle and the manufacturer attests in the conversion system's certification application that the diagnostic system and vehicle are unchanged;
- (A) Verification of Standardized Requirements. The requirement for production engine or vehicle evaluation testing described above in Section 5(f)(5) of these procedures applies, with the following exceptions:
- (i.) Manufacturers are not required to test diagnostics that were previously demonstrated prior to certification, as required in Section 4(e)(v) of these procedures for the monitoring system demonstration.
- (B) Verification and Reporting of In-use Monitoring Performance. For the in-use monitoring performance testing described in California Code of Regulations, title 13, section 1971.1, subdivision (l)(3) for heavy-duty engines and California Code of Regulations, title 13, section 1968.2, subdivision (j)(3) for light- and medium-duty vehicles, conversion manufacturers must submit a plan to the Executive Officer for review and approval that describes the types and number of conversion vehicles to be tested, the sampling method, the time line to collect the data, and the reporting format. The hybrid conversion system manufacturer must submit the plan within 30 days after its first 50 California-certified hybrid conversion systems have been installed on an eligible base vehicle or engine. As part of this plan, the manufacturer must submit data to the Executive Officer for at least five of these vehicles. The Executive Officer shall approve the plan upon determining that the plan provides for effective collection of data from a sample of vehicles that, at a minimum, is 5 of the 50 or more converted hybrid vehicles produced for sale in California; the plan will likely result in the collection and submittal of data within the required time frame; the plan will generate data that is representative of California drivers and temperatures; and the plan does not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles with the highest in-use performance ratios. Conversion manufacturers must collect and report the data to ARB within 12 months after the 50th conversion system has been installed per test group or engine

family. Failure to collect and submit the required data and/or failure to comply with the in-use performance ratios defined in California Code of Regulations, title 13, section 1971.1, subdivision (d)(3.2) and California Code of Regulations, title 13, section 1968.2, subdivision (d)(3.2) may result in withdrawal of the exemption and vehicle recall, at the Executive Officer's discretion.

- (g) Tier 3 OBD System Compliance Plan. For all hybrid vehicle conversion systems that do not meet all of the requirements specified in Section 6(e) of these procedures, the manufacturer must submit a plan to meet Tier 3 OBD requirements to the Executive Officer for approval as part of its Tier 2 application. The plan must include data and engineering evaluations that describe the OBD system's current state of compliance compared to the Tier 3 OBD requirements of Section 6(e) of these procedures, and the necessary improvements that are required for full Tier 3 compliance. The Executive Officer shall approve the plan if it is determined the manufacturer has demonstrated a good-faith effort to meet Tier 3 OBD requirements in full by evaluating and planning for implementation of the required monitoring technology.

6. TIER 3: FINAL CERTIFICATION REQUIREMENTS

- (a) Tier 3 Emission Compliance. In order to receive a Tier 3 Executive Order, a hybrid conversion system must demonstrate at least a ten percent CO₂ reduction and no increase in NO_x, HC, CO, or PM emissions pursuant to Section 7 of these procedures, and no increase in evaporative emissions pursuant to Section 4(a) of these procedures.
- (b) A manufacturer shall receive a Tier 3 Executive Order authorizing installation and California sale of its hybrid conversion system upon successful demonstration to the Executive Officer that the system meets the requirements of Sections 3 and 6 of these procedures.
- (c) A hybrid conversion system is not required to receive Tier 1 or Tier 2 Executive Orders prior to being eligible for a Tier 3 Executive Order as long as it meets the Tier 3 certification requirements these procedures.
- (d) Data Reporting. An application for a ARB Tier 3 certification of a hybrid conversion system that has previously received Tier 1 or Tier 2 certification pursuant to Sections 4 or 5 of these procedures must include the information identified in Section 4(d) for the applicable Tier 1 or Tier 2 certified hybrid conversion systems sold or leased in California. Such information must be valid as of 90 days prior to the Tier 3 application submittal date.

- (e) Tier 3 On-Board Diagnostics Requirements. All Tier 2 OBD requirements described above in Section 5(f) of these procedures must be met. Additionally, the following requirements must also be met:
- (1) Monitoring Requirements. Added electronic hybrid components/systems that either provide input (directly or indirectly) to or receive commands from the on-board hybrid system computer(s) and meet the definition of a comprehensive component according to California Code of Regulations, title 13, section 1971.1 for heavy-duty engines or California Code of Regulations, title 13, section 1968.2 for medium-duty vehicles or engines must comply with the monitoring requirements of California Code of Regulations, title 13, section 1971.1, subdivision (g)(3) or California Code of Regulations, title 13, section 1968.2, subdivisions (e)(15) or (f)(15) depending on the vehicle or engine being converted;
 - (2) Monitoring Conditions. The monitoring conditions described in California Code of Regulations, title 13, section 1971.1, subdivision (d)(3.2.2) for heavy-duty vehicles and California Code of Regulations, title 13, section 1968.2, subdivision (d)(3.2) for light- and medium-duty vehicles are applicable;
 - (3) Hybrid System Diagnostic Link Connector (HSDLC). If the vehicle includes a dedicated HSDLC to communicate with the hybrid diagnostic system, the HSDLC must be distinguished from the base vehicle's OBD system DLC by locating the HSDLC in the vehicle interior to the right of the centerline of the vehicle;
 - (4) OBD System Modifications. The requirement for modifications to the base engine's OBD system described above in Section 5(f)(3) of these procedures applies with the following exceptions: affected monitors that are subject to the OBD system demonstration testing requirements of California Code of Regulations, title 13, section 1971.1, subdivisions (i)(3) and (i)(4) or California Code of Regulations, title 13, section 1968.2, subdivisions (h)(3) and (h)(4) will have to be revalidated according to the aforementioned subsections except that in lieu of a full useful life test vehicle, the test vehicle may be a low-mileage vehicle that is fitted with bench-aged or road-aged parts; and
 - (5) Monitoring System Demonstration Requirements. Except as described in Section 5(f)(5)(A) of these procedures, below, the OBD system demonstration requirements that are described in Section 4(e)(4) of these procedures are applicable to Tier 3 vehicles.
 - (A) Monitors Required for Testing.
 - (i.) Chassis-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to chassis dynamometer emission standards,

the monitors to be tested are described in California Code of Regulations, title 13, section 1968.2, subdivision (h)(4) for light- and medium-duty vehicles.

- (ii.) Engine-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to engine-dynamometer emission standards, aftermarket converter manufacturers must demonstrate a maximum of five major monitors that are subject to the OBD system demonstration testing requirements of California Code of Regulations, title 13, section 1971.1, subdivisions (i)(3) and (i)(4) or California Code of Regulations, title 13, section 1968.2, subdivisions (h)(3) and (h)(4). The monitors selected for testing are subject to the OBD system demonstration testing requirements of California Code of Regulations, title 13, section 1971.1, subdivisions (i)(3) and (i)(4) or California Code of Regulations, title 13, section 1968.2, subdivisions (h)(3) and (h)(4) except that, in lieu of a full useful life test vehicle, the test vehicle may be a low-mileage vehicle that is fitted with bench-aged or road-aged parts of key emission control components to represent a full useful life vehicle. The aged components should, at a minimum, include aftertreatment components and sensors, fuel injectors, and fuel pumps. The aging plan for the test vehicle must be submitted to the Executive Officer for review and approval as a portion of the demonstration test plan described in Section 6(e)(v)(C) of these procedures, below. The Executive Officer shall approve the aging plan if it is determined through engineering judgement that the test vehicle reasonably represents a full useful life vehicle.

(B) Monitor Selection

- (i.) Chassis-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to chassis dynamometer emission standards, all monitors described in California Code of Regulations, title 13, section 1968.2, subdivision (h)(4) for light- and medium-duty vehicles that are included in the OEM vehicle are required to be demonstrated.
- (ii.) Engine-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to engine-dynamometer emission standards, the maximum of five monitors to be tested shall be selected by the Executive Officer after the conversion system manufacturer has completed its allotment of Tier 2 vehicles, or after the manufacturer has informed the Executive Officer of its intent to request Tier 3 approval of its conversion system, as applicable, whichever is earlier.

- (C) Demonstration Test Plan. Prior to conducting the demonstration tests, conversion manufacturers must submit a test plan to the Executive Officer

for review and approval that describes the types and number of conversion vehicles to be tested; vehicle aging methods; the test procedures, including the pre-conditioning cycles, test cycles, and fault implantation method; the threshold part development; the timeline to collect the data; and the reporting format in which the manufacturer shall submit a plan for providing emission test data to the Executive Officer for approval. The manufacturer must not begin testing until after the Executive Officer approves the demonstration test plan. Once the test plan is approved, testing must proceed according to the following requirements:

- (i.) Chassis-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to chassis dynamometer emission standards, demonstration testing must follow the testing procedures described in California Code of Regulations, title 13, section 1968.2, subdivision (h)(5) for light- and medium-duty vehicles.
 - (ii.) Engine-Dynamometer Certified Vehicles: For converted vehicles that were originally certified to engine-dynamometer emission standards, demonstration testing must follow the testing procedures described above in Section 5(f)(5)(C) of these procedures.
- (6) Production Engine or Vehicle Evaluation Testing. Production evaluation testing, described in California Code of Regulations, title 13, section 1971.1, subdivisions (l)(1) through (l)(3) and California Code of Regulations, title 13, section 1968.2, subdivisions (j)(1) through (j)(3), will need to be revalidated, and the data collected and reported to ARB before Tier 3 approval is granted. Systems that are being carried over from a previously approved Tier 1 or Tier 2 system are exempt from further production engine or vehicle evaluation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1 or Tier 2 approved system and vehicle and the manufacturer attests in its hybrid conversion system application that the diagnostic system and vehicle are unchanged.

7. HYBRID TRUCK AND BUS TECHNOLOGY EXHAUST EMISSION TEST PROCEDURES

(a) General Requirements

- (1) A hybrid conversion of an ARB-certified vehicle between 6,001 and 14,000 lbs. GVW, or an ARB-certified engine installed in such a vehicle, must demonstrate compliance with these procedure's exhaust emission requirements pursuant to Section 7(d).

- (2) A hybrid conversion of an ARB-certified engine installed in a vehicle over 14,000 lbs. GVW may demonstrate compliance with these procedure's exhaust emission requirements pursuant to either Section 7(c) or Section 7(d).
- (3) In lieu of exhaust emission testing pursuant to these procedures, a manufacturer must provide an engineering evaluation demonstrating that hybridization of the base engine or vehicle will not increase PM emissions. The Executive Officer shall evaluate said demonstration based upon data and other information provided by the manufacturer, including engine certification data, and his or her engineering evaluation of whether hybridization of the base engine or vehicle is likely to increase PM emissions; and
- (4) A compression ignition engine shall be exempted from CO and/or HC exhaust emission test compliance evaluation pursuant to Section 7(c)(6) and Section (d)(5) of these procedures if the manufacturer provides an engineering evaluation demonstrating that emissions of said pollutant(s) are inherently low, and hybridization of the base engine or vehicle is unlikely to increase their emissions. The Executive Officer shall approve such evaluation if he or she determines, based upon data and other information provided by the manufacturer, including engine certification data, and his or her engineering judgement, that the hybrid system's operational characteristics are unlikely to increase emissions of these pollutants from the base engine or vehicle.

(b) Hybrid Technology Emission Test Plan

The manufacturer must submit a proposed Hybrid Technology Emission Test Plan as part of the application for Tier 2 or Tier 3 certification. The proposed Hybrid Technology Emission Test Plan must be submitted at least sixty days prior to the proposed commencement of emission testing, and the manufacturer may not commence emission testing until it the proposed plan been approved in writing by the Executive Officer. The Executive Officer will evaluate the Hybrid Technology Emission Test Plan based upon his or her engineering judgement and the data and information provided by the applicant as to proposed testing complies with requirements of these procedures, and represents a good faith effort by the applicant to utilize drive cycles that most accurately reflect how the hybrid vehicle will be operated in California and collect accurate emission data that is indicative of the in-use impact of converting the applicable base engine or vehicle.

The Hybrid Technology Emission Test Plan is to be provided in a format to be determined by the Executive Officer. At a minimum, the Hybrid Technology Emission Test Plan must include the following elements:

- (1) Contact Information: Identification of the contact person, phone number, physical address, and e-mail address of the responsible party submitting the application, and whether they are business or personal;
- (2) Proposed Logistical Information: Proposed test date(s), location(s) or test facilities, and entity conducting the testing. Only emission testing conducted on dates and as otherwise described in this section shall be considered valid for the purposes of these procedures. ARB reserves the right to have its employee(s) or representative(s) present during emission testing;
- (3) Proposed Base and Hybrid Engine Information: Make(s), model(s) and model year(s); anticipated mileage at test start; fuel used; displacement (L); aspiration; maximum power (kW) and torque (Nm); emission aftertreatment technology; California NO_x, HC, CO, and PM certification level; and family emission limit (FEL);
- (4) Proposed Base and Hybrid Vehicle Information: Curb weight(s), gross vehicle weight rating(s), average loaded vehicle weight(s) and test weight(s); anticipated mileage at test start; drive train description(s); and California NO_x, HC, CO and PM certification levels;
- (5) Proposed Hybrid Energy Storage System Information: Battery description, including specific energy, battery pack voltage, number of battery modules, and an estimate of battery pack cycle life. The manufacturer shall describe the battery management system, battery pack thermal management strategy (active or passive cooling), the weight of each battery module, the weight of the battery pack (including removable pack structures), and any energy storage devices in addition to, or in lieu of, batteries, such as ultra-capacitors, flywheels, hydraulic assist devices, or other energy storage technologies;
- (6) Conversion description: including parts removed from base vehicle, engine control system modifications, all major parts installed, calibration identification(s), and electronic copy of calibration file(s);
- (7) Proposed Operation of Mechanical and Electrical Accessories: Description of the base and hybrid vehicle's mechanical and electrical accessories and their proposed usage during emission testing; and
- (8) Additional Requirements: Applicants proposing to conduct emission testing pursuant to Section 7(c) of these procedures must also include the following in their proposed Hybrid Technology Emission Test Plan:
 - (A) Proposed Equipment: Description of the proposed equipment, and applicable equipment measurement techniques and calibrations, to be

used for measuring required engine and vehicle operating parameters, exhaust emissions, location, elevation, and weather conditions;

- (B) Proposed Test Route: Proposed test route descriptions, including route distances (miles) and times (seconds); average anticipated vehicle speeds (mph), percent idle time (%); anticipated average PKE (feet per second squared); minimum elevation (feet above sea level); maximum elevation (feet above sea level); and aerial maps of proposed test routes;
- (C) Cold-Start Strategy: Proposed strategy for evaluating cold-start emissions from the base and hybrid vehicle, pursuant to these procedures; and
- (D) Defining a Valid Test Run: Proposed thresholds for the following statistics to ensure that all base and hybrid vehicles were driven over the both of the required test routes as similarly as possible:
 - (i.) For the transient test route, the proposed coefficient of variation (CoV) of average speed for each of the eight or more total base and hybrid vehicle test runs, and proposed CoV of average PKE for the same base and hybrid vehicle test runs;
 - (ii.) For the high-speed cruise route, proposed CoV of average driving speed and proposed proximity to 55 mph at which the vehicle spends at least 80 percent of its time; and
 - (iii.) For both routes, what percent of time the vehicles are anticipated to operate at zero speed (i.e., idle), and proposed criteria for excluding a test run if idle time differs significantly between runs. A vehicle with an engine automatic stop-start system must be emission tested with such system disabled.

(c) Portable Emission Measurement System (PEMS) Testing

Unless otherwise indicated in this section, emission test set-up and steps to execute the test process follows the on-road testing element of *SAE International J1526: Fuel Consumption Test Procedure – Engineering Method* (SEPT 2015), incorporated by reference herein. PEMS equipment specifications, measurement principles, and verification requirements, and emission measurement, calibration, and verification methodologies are defined in 40 C.F.R., Part 1065, incorporated by reference herein.

(1) Vehicle Selection and Preparation.

The hybrid vehicle used for emission testing is to be the base engine or vehicle converted with the proposed conversion system, as identified in the manufacturer's conversion system application, while the base vehicle with which it is compared must reflect the "pre-converted" base engine or vehicle

configuration. For post-transmission hybrids, the manufacturer may propose as part of its Hybrid Technology Emission Test Plan to utilize the converted hybrid vehicle with the hybrid system disabled as the base vehicle if it can demonstrate that the engine and vehicle with the hybrid system disabled will operate with the same emission characteristics of the pre-converted vehicle.

(A) Mileage. Minimum mileage of baseline and hybrid vehicles for testing must be as follows:

- (i.) To ensure emission stability, the baseline vehicle and the hybrid vehicle (after installation of the hybrid conversion system) must have accumulated a minimum of 4,000 miles. Utility trucks may alternately accumulate a minimum of 125 hours of operation prior to testing, if verified by a non-resettable, vehicle-integrated hour meter.
- (ii.) If the odometer of one vehicle is less than 5,000 miles, the mileage on all baseline and hybrid vehicles must be within 1,000 miles of each other.
- (iii.) If the odometer on all vehicles is greater than 5,000 miles but less than 10,000 miles on one vehicle, the mileage on all vehicles must be within 3,000 miles of each other.
- (iv.) If the odometer on all vehicles is greater than 10,000 miles but less than 30,000 miles on one vehicle, the mileage on all vehicles must be within 10,000 miles of each other.
- (v.) If the odometer is greater than 30,000 miles on all vehicles, the mileage on all vehicles must be within 50,000 miles of each other.
- (vi.) Neither vehicle may have mileage that exceeds its regulatory useful life.

(B) Vehicle Test Weight. Heavy-duty vehicles are to be tested at the prescribed weight identified in the *“California Interim Certification Procedures for 2004 and Subsequent Model Hybrid Electric and Other Hybrid Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes”* (Amended December 12, 2013) Section D. 1.4.2. Other vehicles’ test weight are to follow 40 C.F.R. Part 86.129-94 specifications.

(C) Vehicle Pre-Conditioning. Vehicle conditioning must be conducted to minimize the possibility of an infrequent diesel particulate filter (DPF) regeneration event during the emission test runs. The objective of the process will be to minimize hybrid and base vehicle emission variability due to unplanned regeneration events. The preconditioning may consist of a stationary forced DPF regeneration using a service tool or other passive regeneration methods recommended by the engine or after-treatment

manufacturer. If a DPF regeneration occurs during a run, the run will be invalid and must be removed from the test data set. If the user lacks the capability to monitor appropriate regeneration messages over the controller area network (CAN) data bus, the exhaust temperature across the DPF should be measured to determine occurrence of an active DPF regeneration as indicated by a sustained temperature increase across the DPF. Emission results are to be adjusted to account for regeneration events, pursuant to 40 C.F.R., Part 86.004-28(i)(1).

(2) Test Route Selection.

- (A) The hybrid and base vehicle must be emission tested over at least four valid test runs, as defined by the manufacturer and approved by the Executive Officer pursuant to these procedures, for each of the following two test routes:
- (i) A “Transient” route, with an average driving speed of between 15 and 30 mph and an average positive kinetic energy (PKE) of between 0.85 and 1.50 feet per second squared. This route should be representative of the transient, slower speed operation anticipated for the hybrid vehicle class and vocation, and should avoid freeway driving; and
 - (ii) A “High-Speed Cruise” route, with the vehicle operating at least 80 percent of the time at 55 mph cruise \pm X mph, as measured by GPS, where “X” equals the manufacturer’s proposed maximum feasible proximity, in mph, to a 55 mph cruise that the tested vehicles can operate for at least 80 percent of the high-speed cruise route test time. For example, if X = 2 mph, the vehicle must operate between 53 and 57 mph for at least 80 percent of the high-speed cruise test route.
- (B) A manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, a transient route with differing average driving speed and/or PKE profile than that identified in Section 7(c)(2)(A)(ii). The Executive Officer may approve a test route meeting a different proposed average driving speed and/or PKE profile if he or she determines, based upon his or her engineering judgement and data provided by the applicant, that the alternate test route more accurately depicts the hybrid vehicle’s anticipated in-use activity.
- (C) All test runs should be of at least 20 minutes in duration, with an average grade of less than 5 percent.
- (D) The proposed high-speed cruise test route and proposed transient test route must each begin and end at the same location (i.e., must be a closed circuit or loop), with the exception of for cold-start tests, as described in Section 7(c)(3)(B). Multiple “laps” may represent a single test route. For example, a manufacturer may propose its 20 minute transient test route be represented by two ten minute laps over the same circuit. If the proposed test route includes multiple laps, ARB recommends that each lap must have a length of at least 5 miles.

- (E) A hybrid vehicle incapable of 55 mph operation due to a speed limiter may utilize the vehicle's maximum operational speed instead of 55 mph for the high-speed cruise route. If the vehicle's maximum operational speed is verified by the Executive Officer and approved as part of the proposed Hybrid Technology Emission Test Plan.
- (F) The surface of all roads must be concrete or asphalt, and may not exceed 5,500 feet above sea level at any point. To maximize repeatability, the manufacturer may wish to propose a test route with minimal anticipated traffic during proposed test times, with use of cloverleaves at turnaround points to allow for consistent operation of the base and hybrid vehicles during turns.
- (G) The manufacturer must respect all local, State, and federal traffic- and safety-related requirements during vehicle testing.
- (H) Nothing in these procedures is to be construed as prohibiting a manufacturer from conducting PEMS testing on a test track rather than an over-the-road route. In lieu of the drive cycle selection criteria identified in Section 7(c)(2)(i) and (ii) of these procedures, above, PEMS testing conducted on a test track must utilize a speed trace to conform to the duty cycles identified in Section 7(d)(2) of these procedures.

(3) Emission Testing.

Unless otherwise indicated in this section, PEMS equipment specifications, measurement principles, verification requirements, and emissions measurement, calibration, and verification methodologies are provided in 40 C.F.R. Part 1065, Subpart J.

- (A) Overview. For each of the at least four runs over the high-speed cruise test route and each of the at least four runs over the transient test route, emissions must be recorded simultaneously on the hybrid and base vehicle, with one vehicle no more than one minute behind the other. For the high-speed cruise route, the vehicles must be spaced at least 1,500 feet apart during cruising operation. The four test runs conducted over both the high-speed cruise and the transient test routes must each include at least one "cold-start" test. ARB recommends that manufacturers dedicate at least two days to PEMS testing: one day to conduct at least four runs over the transient test route, with the first run of the day to be a cold-start test, and a second day to conduct at least four runs over the high-speed cruise route, with the first run of the day to be a cold-start test.
- (B) Charge-Depleting Hybrid-Electric Vehicles. A charge-depleting hybrid electric vehicle are to be emission tested in charge-sustaining mode, from the point at which the engine first turns on at the end of the vehicle's AER. A charge-

depleting hybrid-electric vehicle for which the ratio of charge-sustaining mode relative to charge-depleting mode is at least 0.98 must meet the emission test requirements of a charge-sustaining hybrid for the purposes of these procedures.

- (C) Cold-Start Tests. Cold-start tests must include all emissions data from the moment the hybrid and base vehicle are started, including the actual start event. The hybrid and base vehicle must be cold soaked for a minimum of 12 hours at temperatures between 32 and 86 degrees Fahrenheit prior to each cold-start test. The vehicles must remain in the key off position for at least one minute, after which the test cycle begins. All test cycles must have a minimum of one minute of idling with continued emission sampling at the end of the cycle before it terminates, such that the analyzers are not missing emissions that are still in the sampling train. The test route used for each cold-start test run must be the same as that used for the hot-start test runs, with the exception that the cold-start test may begin at a different location on the test route, if it is infeasible to park the vehicle at the beginning of the test route for the required 12 hour cold soak period.
- (i) Charge-Depleting Hybrids with AER: A cold-start test for a charge-depleting hybrid with AER is to be conducted after the vehicle has transitioned from charge-depleting and charge-sustaining mode, and then been cold soaked for the minimum 12 hour period (without charging the vehicle during the cold soak). Testing must measure and include emission data from the point at which the engine first turns on, including the actual engine start event.
- (D) Hot-Start Tests: The hybrid and base vehicles must be warmed to operating temperature. Once the vehicles are at operating temperature, they must be turned off and will remain in the "key off" position for approximately 20 to 30 minutes. The vehicles are to be restarted and idled for one minute, at which time the test cycle is to begin and emission measurements are to be taken. At the end of the test cycle, the hybrid and base vehicles are to be returned to the "key off" condition.
- (E) Net Energy Change. Net energy change calculations and variance determinations, and state-of-charge correction procedures must follow SAE International J2711: Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles (SEP2002).
- (F) Defining a Valid Test Run. All vehicles must be driven similarly over the high-speed cruise route and over the transient route, respectively. ARB recommends an applicant use the criteria identified in Section 7(c)(3)(F)(i) and (ii), below, for identifying valid test runs pursuant to these procedures.

- (i) ARB recommends that neither the CoV of average driving speed nor the CoV of average PKE for all test runs as driven over the transient route exceed 10 percent; and
- (ii) ARB recommends that the CoV of average driving speed for all test runs as driven over the high-speed cruise route do not exceed 10 percent.

A manufacturer may propose alternate average driving speed or PKE variance thresholds as part of its Hybrid Technology Emission Test Plan. The Executive Officer will evaluate proposed alternate criteria based upon his or her engineering judgement and data provided by the manufacturer and from other sources, and make his or her determination as to whether the proposed alternate criteria provide an adequate basis for ensuring the proposed base and hybrid vehicles are being driven as consistently as possible over the proposed test route(s), and whether proposed alternate criteria are likely to have an impact on validity of emission results. Reasons for approving alternate criteria for defining a valid test run include, but are not limited to, significant hybrid and base vehicle powertrain differences resulting in potential for inconsistent performance between the two vehicles, or potential for unavoidable high traffic volume during emission testing.

- (G) If the CoV of the average driving speed or CoV of average PKE for the minimum of eight hybrid and base vehicle test runs over the transient route do not meet the CoV criteria in the manufacturer's Hybrid Technology Emission Test Plan, the manufacturer must exclude the run that is furthest from the mean for the noncompliant statistical set (average driving speed or PKE). If this value is attributed to a hybrid vehicle test run, the value for the corresponding base vehicle test run must also be excluded, and the test run must be repeated by both vehicles. This process is to be repeated until the average driving speed and PKE meet the applicable CoV criteria identified in the manufacturer's Hybrid Technology Emission Test Plan. The same process applies for individual test runs that do not meet the criteria, as identified in the manufacturer's Hybrid Technology Emission Test Plan, for a minimum consistency in percent idle time among test runs and, for the high speed cruise route, proximity to 55 mph cruise that each vehicle spends at least 80 percent of its time.
- (H) The manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, a statistical method for identifying and excluding measured emission data outliers. The Executive Officer will evaluate any proposed method for approval based upon the method's adherence to established scientific and statistical principles for identifying outliers, his or her determination that the statistical method would be consistently applied to both high and low emission results, and his or her engineering judgement regarding whether application of the proposed principle is likely to exclude emission results that are atypical of the base or hybrid vehicle.

- (l) While a test run deemed invalid pursuant to Section 7(c)(3)(G) and (H) is not to be used in emission calculations pursuant to these procedures, the applicant must disclose, when reporting test results to ARB, emissions and other data collected for all test runs (including those deemed invalid) conducted on days designated as an official emission test day in the applicant's Hybrid Technology Emission Test Plan.

(4) Data Collection and Quality Control

The data identified in this subsection must be collected from SAE J1939 broadcast data, analog instrumentation, field records, or manufacturer information/specification sheets for all baseline and hybrid vehicles participating in PEMS testing. SAE J1939 is incorporated by reference herein. If proprietary equipment or information is needed to collect these signals, the applicant must make this equipment or information available to ARB upon request if needed for the purposes of confirmatory testing.

The actual signal value must always be used instead of a default or limp home value. For purposes of the calculated load, torque, fuel rate, and modeled exhaust flow parameters, manufacturers must report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). "Most accurate values," in this context, must be values of sufficient accuracy, resolution, and filtering to be used for the purposes of in-use emission testing with the engine still in a vehicle (e.g., using PEMS). The following data must be collected for both the base and hybrid vehicle during each test run, and be reported to ARB on a second-by-second interval in a format to be determined by the Executive Officer:

(A) The following data are to be collected from the engine control module (ECM):

- (i.) Engine Reference Torque;
- (ii.) Nominal Friction Percent Torque;
- (iii.) Actual Engine Torque;
- (iv.) Engine Speed;
- (v.) Rechargeable Energy Storage System Battery State-of-Charge (if applicable);
- (vi.) Rechargeable Energy Storage System Net Energy Change (if applicable);
- (vii.) Coolant Temperature;
- (viii.) Engine Fuel Rate;
- (ix.) Intake Air Flow Rate (may be measured by flow sensor);
- (x.) Fuel Temperature;
- (xi.) Fault Status; and

(B) The following data are to be collected by global positioning system (GPS):

- (i.) Vehicle Position (Latitude, Longitude); and
- (ii.) Elevation;
- (iii.) Vehicle Speed (Latitude, Longitude, and Elevation as a function of time are to be measured by GPS; GPS may also be used to correct or calibrate ECU wheel-based speed)

(C) Additional required data and default measurement techniques are identified below:

- (i.) Exhaust Mass Flow – Exhaust Flow Sensor (Pitot);
- (ii.) Exhaust Temperature at Aftertreatment System Inlet and Tailpipe – Temperature Sensor;
- (iii.) Ambient Humidity – Humidity Sensor;
- (iv.) Ambient Temperature – Temperature Sensor; and
- (v.) Ambient Pressure – Pressure Sensor;

(D) The following data and information are to be calculated and reported to ARB for each test run:

- (i.) Cycle time (seconds);
- (ii.) Maximum vehicle speed (mph);
- (iii.) Average vehicle speed (mph);
- (iv.) Time (seconds) and percent of time at the following speeds (in mph): zero speed; 0+ to 5; 5+ to 10; 10+ to 15; 15+ to 20; 20+ to 25; 25+ to 30; 30+ to 35; 35+ to 40; 40+ to 45; 45+ to 50; 50+ to 55; 55+ to 60; 60+ to 65; 65+;
- (v.) Number of stops;
- (vi.) Average PKE (feet per second²); and
- (vii.) Plot of second-by-second speed versus time trace for both the hybrid and base vehicle; and
- (viii.) Additional data collected pursuant to Section 7(c)(4)(A), (B), or (C), if so requested by the Executive Officer.

(E) Nitric oxide, nitrogen dioxide, CO, CO₂, CH₄, and other HC emissions are to be measured by the PEMS unit. Fuel consumption of the hybrid and base vehicle are to be calculated based on mass balance of carbon-bearing emission gases, as described in 40 C.F.R., Part 86 and SAE test method J1094a, incorporated by reference herein; and

(F) The manufacturer must disclose to ARB data regarding all test runs conducted during the days of emission testing identified pursuant to Section 7(b)(1)(B) of these procedures, including test runs that are not included in emissions calculations and the reason(s) for their exclusion.

(5) Emission Calculations.

Average mass-based (grams per mile) emissions are first calculated, as adjusted for net energy change, for each of the following:

- (A) Hybrid vehicle as driven over the high-speed cruise route ($A_{\text{HybridCruise}}$)
- (B) Base vehicle as driven over the high-speed cruise route ($A_{\text{BaseCruise}}$)
- (C) Hybrid vehicle as driven over the transient route ($A_{\text{HybridTransient}}$)

(D) Base vehicle as driven over the transient route ($A_{\text{BaseTransient}}$)

Emissions for each of the above ((A), (B), (C), and (D)) are to be calculated as:

$$A = ((1/7)(M_{\text{cs}}/D_{\text{cs}}) + (6/7)(M_{\text{hs}}/D_{\text{hs}}))$$

Where:

A = grams per mile emissions

M_{cs} = cold-start test emissions for all valid cold-start tests

D_{cs} = distance the vehicle drives during all valid cold-start tests

M_{hs} = hot-start test emissions for all valid hot-start tests

D_{hs} = distance the vehicle drives during all valid hot-start tests

Average weighted emissions for each are then calculated as:

Average weighted hybrid emissions (A_{Hybrid}) =

$$(A_{\text{HybridCruise}} * 0.18) + (A_{\text{HybridTransient}} * 0.82)$$

Average weighted base vehicle emissions (A_{Base}) =

$$(A_{\text{BaseCruise}} * 0.18) + (A_{\text{BaseTransient}} * 0.82)$$

CO₂ exhaust emissions for the purposes of compliance are to be calculated based upon emissions directly measured by the PEMS unit utilizing the carbon balance method.

(6) Criteria Pollutant Pass-Fail Determination. For each measured criteria pollutant, if $A_{\text{Hybrid}} \leq (A_{\text{Base}} * 1.10)$, where 1.10 reflects a 10 percent test allowance, then the hybrid vehicle is found to not increase emissions of that pollutant. If $A_{\text{Hybrid}} > (A_{\text{Base}} * 1.10)$ for NO_x, CO, or HC, then the hybrid vehicle has failed the emission test. A manufacturer wishing to repeat the emissions test must first submit a new Hybrid Technology Emission Test Plan pursuant to these procedures for Executive Officer approval. Such a plan must include a detailed description of what changes are proposed in the subsequent emission testing to address the hybrid vehicle's failure to meet emission requirements.

(7) CO₂ Emission Pass-Fail Determination. Percent CO₂ emission reduction is calculated as:

$$\text{Percent CO}_2 \text{ Reduction} = ((A_{\text{Base}} - A_{\text{Hybrid}})/A_{\text{Base}}) * 100$$

(A) Vehicles with AER. For a hybrid vehicle between 6,001 and 8,500 pounds GVW with AER, a utility factor (UF) shall be applied to average weighted hybrid CO₂ emissions:

$$A_{\text{Hybrid}} = ((A_{\text{HybridCruise}} * 0.18) + (A_{\text{HybridTransient}} * 0.82)) * (1 - UF(D))$$

Where UF(D) is the utility factor for a vehicle that achieves at least D miles AER. For such a vehicle, UF(D) are to be determined according to SAE International's Surface Vehicle Information Report J2841 SEP2010 (SAE J2841), incorporated by reference herein, from the Fleet Utility Factors (FUF) Table in Appendix B or using a polynomial curve fit with "FUF Fit" coefficients from Table 2: Utility Factor Equation Coefficients.

For vehicles above 8,500 pounds with AER, a manufacturer may propose a UF as part of its Hybrid Technology Emission Test Plan, to be calculated as the FUF for a medium- or heavy-duty hybrid vehicle with AER pursuant to SAE J2841 procedures and based upon electronic in-use daily mileage data for the proposed hybrid heavy-duty vehicle class and vocation. The Executive Officer may approve, deny, or adjust the proposed UF based upon his or her engineering judgement and evaluation of this and other available relevant data and information.

(d) Chassis Dynamometer Emission Testing

Unless otherwise indicated in this section, hybrid and base vehicle emission testing are to conform to the requirements of *California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric and Other Hybrid Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes* (Amended December 13, 2013), Section D, incorporated by reference herein. All chassis dynamometer equipment specifications, measurement principles, verification requirements, of emissions measurement, calibration, and verification methodologies are provided in 40 C.F.R., Part 1065, incorporated by reference herein.

- (1) Vehicle Selection and Preparation. Vehicle selection and preparation must conform to the requirements of Section 7(c)(1) of these procedures.
- (2) Duty Cycle Selection. The hybrid and baseline vehicle are to each be tested over two duty cycles reflective of transient-like and high-speed cruise operation. A light- or medium-duty vehicle is to be tested over the Federal Test Procedure (FTP-75) to represent transient-like operation. A heavy-duty vehicle is to be tested over the Transient Portion of the Heavy Heavy-Duty Truck 5 Mode Cycle to represent transient-like operation, with the exception of transit buses which are to use the Orange County Bus Cycle. All vehicles must be tested over the 55 mph Cruise Cycle to represent high-speed cruise operation.

A heavy-duty vehicle with ePTO may conduct chassis-dynamometer emission testing pursuant to the hybrid-PTO test procedures defined in 40 C.F.R., Part 1037.525 in lieu of the specified transient-like duty cycle. A manufacturer may propose, as part of its Hybrid Technology Emission Test

Plan, an alternate duty cycle in lieu of the transient-like duty cycles identified in this section. The Executive Officer may approve this alternate duty cycle if he or she determines based upon his or her engineering judgement, and data provided by the applicant that the proposed alternate duty cycle more accurately depicts the hybrid vehicle's anticipated in-use activity as operated by California fleets.

- (3) Charge-Depleting Hybrid-Electric Vehicles. A charge-depleting hybrid electric vehicle must be emission-tested beginning in charge-sustaining mode, from the point at which the engine first turns on at the end of the vehicle's AER. A charge-depleting hybrid-electric vehicle for which the ratio of in-use charge sustaining mode relative to charge-depleting mode is at least 0.98 must meet the emission test requirements of a charge-sustaining hybrid for the purposes of these procedures.
- (4) Emission Calculations. Average exhaust emissions calculations are conducted pursuant to Section 7(c)(5) of these procedures, with the exception that for a vehicle between 6,001 and 14,000 pounds, emission calculations for Section 7(c)(5)(A), (B), (C), and (D) shall be:

$$A = ((0.43)(M_{cs}/D_{cs}) + (0.57)(M_{hs}/D_{hs}))$$

- (5) Emission Pass-Fail Determinations. NO_x, HC, and CO emission pass-fail determinations are conducted pursuant to Section 7(c)(6) of these procedures, and CO₂ emission pass fail determination are conducted to Section 7(c)(7) of these procedures.

(e.) All-Electric Range Determination

A hybrid vehicle's AER is defined as the distance, after the battery has been fully charged, that the vehicle is capable of traveling electrically (with the engine off) before the engine turns on for the first time, as described in this section. The vehicle is to be tested for AER in default mode, or in normal mode if the vehicle does not have a default mode.

- (1) PEMS Tested Vehicles. A vehicle that conducts PEMS testing pursuant to Section 7(c) of these procedures must demonstrate its AER over the transient test route on which the vehicle is PEMS tested. The location at which the engine first turns on must be captured by the GPS system, and the distance traveled must be identified by the vehicle odometer or other mechanism, to be approved by the Executive Officer. The altitude at the start of the test and the point the engine first turns on must be recorded, and the altitude of the location at which the engine first turns on may not be more than 100 feet lower than the altitude of the starting location. ARB recommends that the starting point of such a test route be no more than 100 feet higher elevation

than the lowest point in the route, to avoid the possibility of invalid AER determinations.

- (2) Other Vehicles. A vehicle that demonstrates that it meets these test procedures' emissions criteria on a chassis dynamometer is to demonstrate its AER on the chassis dynamometer over the transient-like duty cycle utilized pursuant to Section 7(d) of these procedures.

8. REQUEST FOR CERTIFICATION

- (a) Overview. To obtain ARB Tier 1, Tier 2, or Tier 3 certification of the hybrid conversion system, the applicant must submit an application to the Executive Officer pursuant to Section 8 of these procedures. The Executive Officer will use the information provided during the application process to help determine whether the hybrid conversion system relies upon sound principles of science and engineering to meet required eligibility criteria, the need for additional analyses, and the appropriateness of allowing for alternatives to the prescribed requirements. The applicant must submit one application for each discrete conversion system as it applies to each potential base vehicle test group or engine family. Supporting data in electronic format may be accepted as part of an application at the discretion of the Executive Officer. An application must be submitted in the format approved by the Executive Officer. The request for certification must include, at a minimum, the following information:
 - (1) Identification as to whether the applicant is requesting Tier 1, Tier 2 or Tier 3 certification;
 - (2) Name, business affiliation, business title, business e-mail address and business telephone number for: (1) the person submitting the application; (2) persons authorized to sign documents for submittal to ARB, and (3) a single point of contact authorized to communicate with ARB staff on behalf of the applicant during the application review process;
 - (3) The applicant's product website information, if applicable;
 - (4) Identification of the proposed hybrid conversion system make(s) and models(s), including, for each: detailed schematics, wiring diagrams, and parts list; identifying part numbers for all major individual components of the hybrid conversion system, including battery pack, traction motor, controller, inverter, and on-board charger (if applicable); and a list of all warranted parts;
- (b) Application Information. The request for certification must, at a minimum, include the following information:
 - (1) Identification as to whether the applicant is requesting Tier 1, Tier 2 or Tier 3 certification;
 - (2) Name, business affiliation, business title, business e-mail address and business telephone number for: (1) the person submitting the application; (2) persons authorized to sign documents for submittal to ARB, and (3) a single point of contact authorized to communicate with ARB staff on behalf of the applicant during the application review process;
 - (3) The applicant's product website information, if applicable;
 - (4) Identification of the proposed hybrid conversion system make(s) and models(s), including, for each: detailed schematics, wiring diagrams, and parts list; identifying part numbers for all major individual components of the hybrid conversion system, including battery pack, traction motor, controller, inverter, and on-board charger (if applicable); and a list of all warranted parts;

- (5) A detailed description of the energy storage system, including (if applicable), battery manufacturer, battery chemistry, connection type (e.g., series, parallel, or other), charge-depleting or sustaining system, weight, power, maximum voltage, and voltage at fifty percent state of charge;
- (6) An explanation of how the hybrid conversion system interacts with or integrates into the base vehicle;
- (7) A description of any modifications made to the base engine or vehicle's original engine hardware or after-treatment device(s), and any modifications made to the base engine original software calibrations;
- (8) An engineering evaluation of potential negative emission impacts of installation of the hybrid conversion system on the base vehicle, including, but not limited to, the potential for increased number of cold starts or low temperature operation leading to increased criteria pollutant emissions, the potential for increased evaporative or exhaust hydrocarbon emissions, and how the hybrid conversion system could potentially change the engine's certified regeneration cycles or events for emission control devices, such as diesel particulate filters;
- (9) A demonstration that the hybrid conversion system meets the general requirements of Section 3 of these procedures and the applicable Tier 1, Tier 2, or Tier 3 certification requirements of Sections 4, 5 or 6 of these procedures, respectively;
- (10) Names and business addresses of the fabrication, assembly line, and test facilities where the hybrid conversion system and its major components are manufactured and tested;
- (11) A description of the criteria the manufacturer uses to authorize a person to install its hybrid conversion system;
- (12) Procedures for installing and maintaining the hybrid conversion system, including tune-up specifications, and discussion of any special tools or techniques required for its proper installation, maintenance, or operation;
- (13) Business names, physical business addresses, business e-mail addresses and business phone numbers of conversion system authorized installers, and a copy of all contract(s) and other written agreements between the hybrid conversion system manufacturer and authorized installer(s);

- (14) A description of the chassis and engine combination(s) on which each proposed hybrid conversion system will be installed, including base vehicle test group and/or base engine family, base vehicle or engine weight class, and the applicable engine emission standards for NMHC, NOx or NMHC + NOx, CO, formaldehyde, and PM;
- (15) A description of any modifications or updates to information provided in any previous application for ARB certification of the applicable hybrid conversion system;
- (16) A proposed Hybrid Technology Emission Test Plan that meets the minimum requirements of Section 7(b) of these procedures (Tier 2 or 3 certification application only);
- (17) A copy of the following: supplemental emission control label(s) required pursuant to Section 3(b) of these procedures; owner's manual required pursuant to Section 3(e) of these procedures; warranty statements required pursuant to Section 10(c) and Section (e) of these procedures; and warranty notifications required pursuant to Section 10(d) of these procedures.
- (18) The Tier 1, Tier 2, and Tier 3 OBD requirements identified in Sections 4, 5, and 6 of these procedures, respectively, may necessitate modification of the base vehicle or engine OBD system. If such modifications are made, the hybrid conversion system manufacturer must fully document and describe in writing all modifications affecting OBD compliance, including added, modified, or removed base vehicle hardware, (e.g., components, wiring) or software changes (e.g., programming, calibration).
- (19) Compliance Statements. The application must be signed and dated by the applicant and include the following statement above the signature and date:

"I affirm that to the best of my knowledge, the information submitted is true, accurate, and complete.

I affirm that to the best of my knowledge this hybrid conversion system does not cause the emission into the ambient air of any noxious or toxic matter that is not emitted in the operation of such motor vehicle without such device.

I understand that Air Resources Board (ARB) approval of this hybrid conversion system, if granted, does not constitute a certification, accreditation, approval, or any other type of endorsement by the ARB of any claims concerning alleged emission benefits of a hybrid conversion system and that no claims

of any kind concerning emission benefits may be made for an approved hybrid conversion system, with the exception of a claim concerning any potential CO₂ emission benefit specified in the device's applicable ARB Executive Order."

- (c) The Executive Officer may require a manufacturer to provide ARB with a market-ready hybrid conversion system or converted hybrid vehicle for inspection and/or testing as part of its application for ARB certification. Such market-ready hybrid conversion system or converted vehicle must be identical in all material respects to the product that will be sold upon receiving ARB certification of the applicable hybrid conversion system. If such a request is made by the Executive Officer, the applicant must submit the market ready hybrid conversion system or converted base vehicle within 30 days or another mutually agreed upon date, or the application may be disapproved. The Executive Officer shall return, at the applicant's expense, the market-ready hybrid conversion system after the hybrid conversion system application has been approved, denied, or withdrawn.

9. HYBRID CONVERSION SYSTEM APPROVAL

- (a) Issuance of Executive Orders. If, after reviewing the test data and other information submitted by the applicant, the Executive Officer determines that the hybrid conversion system meets the requirements of California Code of Regulations, title 13, section 2208.2, he or she shall issue an Executive Order certifying the hybrid conversion system for sale and installation on the vehicle test groups and/or engine families specified in the certification application.
- (1) A manufacturer of a Tier 2- or Tier 3-certified hybrid conversion system that demonstrates at least a 20 percent CO₂ emission reduction pursuant to Section 7 of these procedures will receive an Executive Order identifying the hybrid conversion system as providing said CO₂ emission benefit.
- (A) An Executive Order that identified a 20 percent or greater potential CO₂ emission reductions from the hybrid conversion system will stipulate that said potential reductions are based upon a newly manufactured and installed hybrid conversion system tested in accordance with prescribed test procedures, and that ARB makes no assertion or warranty regarding potential CO₂ emission impacts experienced by individual users over the life of the hybrid conversion system.
- (2) Any potential CO₂ emission benefit identified on, or inferred from, a hybrid conversion system Executive Order may not be used to demonstrate compliance with any rule, regulation, or other air quality mandate, nor may it be credited as part of any emission averaging, banking or trading program.

(b) Carryover and Carry-Across

- (1) Carryover of emission test data from the previous model year to the following model year, and from one test group, engine family, evaporative emissions family, or OBD group, to similar test groups or engine families, may be allowed if the Executive Officer determines that the carryover or carry-across data will adequately represent the emission and OBD monitor performance of the hybrid conversion system to be certified.
- (2) Requests for use of carryover and carry-across data must be accompanied by an engineering analysis that includes test data demonstrating that the emissions performance of the hybrid conversion system and the test group, engine family, evaporative emissions family, or OBD group for which the certification is sought will be adequately represented by the emission and OBD monitor performance of the hybrid conversion system and test group or engine family, and other relevant information.
- (3) Updated Parts or Calibrations. Changes made to the design or operating conditions of a hybrid conversion system must be fully described in writing by the manufacturer and must be reviewed and approved in writing by the Executive Officer. Changes to the design or operating conditions of the hybrid conversion system not approved in advance and in writing by the Executive Officer shall invalidate the hybrid conversion system certification at the Executive Officer's sole discretion.

10. MINIMUM WARRANTY REQUIREMENTS

(a) Product Warranty

Each conversion system manufacturer must warrant to the person having the vehicle or engine converted and to each subsequent purchaser of the converted vehicle or engine that the hybrid conversion system will not cause damage to any part on the converted vehicle or engine, and is free from defects in materials and workmanship that can cause the conversion system to fail to conform with the applicable requirements of California Code of Regulations, title 13, section 2208.2. This warranty must cover customer service and the full repair or replacement costs, including the costs of diagnosis, labor, and parts, and any part on the converted vehicle or engine that is damaged by the hybrid conversion system. This warranty requirement will be effective for the applicable duration identified in Table 1.

The repair or replacement of any part otherwise eligible for warranty coverage may be excluded from such warranty coverage if the hybrid conversion system or

the vehicle or engine in which it is installed has been abused, neglected, or improperly maintained and such abuse, neglect, or improper maintenance was the direct cause of the need for the repair or replacement of the part.

Failure of the converted vehicle or engine owner to ensure scheduled maintenance as recommended by the hybrid conversion system owner's manual, or to keep maintenance records for the vehicle, engine, or hybrid conversion system, may, but will not per se, be grounds for disallowing a warranty claim.

Table 1: Minimum Manufacturer Warranty Periods	
Conversion System Approval Level	Hybrid conversion system minimum warranty period
Tier 1	3 years or 50,000 miles, whichever comes first ¹
Tier 2	5 years or 60,000 miles, whichever comes first ¹
Tier 3	7 years or 70,000 miles, whichever comes first ²
1 – Hybrid conversion systems with ePTO may include a 3,000 hour warranty period in lieu of a minimum mileage. 2 – Hybrid conversion systems with ePTO may include a 4,200 hour warranty period in lieu of a minimum mileage.	

(b) Installation Warranty

Each authorized installer of a hybrid conversion system must warrant to the person having the vehicle or engine converted, and to each subsequent purchaser of the vehicle or engine that the hybrid conversion system will not fail to conform with the requirements of California Code of Regulations, title 13, section 2208.2 due to incorrect installation, and that no part on the converted vehicle or engine will be damaged due to improper installation. Authorized installers of hybrid conversion systems must install only conversion systems of a certified configuration, and must agree to indemnify the person having the vehicle or engine converted, and each subsequent purchaser of the vehicle or engine for the cost of repair of any noncertified vehicle or engine configuration upon which the hybrid conversion system was installed. In addition, the authorized installer must agree to indemnify the person having the vehicle or engine converted, and each subsequent purchaser of the vehicle or engine, for any fines that may be imposed as a result of improper installation of the hybrid conversion system. The warranties and agreements to indemnify must be effective for 3 years or 50,000 miles, whichever occurs first, and must cover the full repair or replacement costs, including the costs of diagnosis, labor, and parts during the installation warranty period, as well as any part on the converted vehicle or engine that is damaged due to incorrect installation of the hybrid conversion system.

(c) Product Warranty Statement.

The applicant must include the following statement in the owner's manual, a copy of which must be provided to each owner upon delivery of the hybrid conversion

system. The applicant may include descriptions of circumstances that may result in a denial of warranty coverage, but these descriptions must not limit warranty coverage in any way.

“YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Applicant's name) warrants that the hybrid conversion system is free from defects in design, materials, workmanship, or operation that can cause significant degradation in emissions or fuel economy performance during the system warranty period, provided there has been no abuse, neglect, improper maintenance, or improper operation of your hybrid conversion system or vehicle, as specified in the owner's manual. Where a warrantable condition exists, (applicant's name) will repair or replace your hybrid conversion system at no cost to you, including diagnosis, parts, and labor. The warranty period for this hybrid conversion system is (years or miles of operation), whichever occurs first.

As the vehicle owner or operator, you are responsible for performing the required maintenance described in your owner's manual. (Applicant's name) recommends that you retain all maintenance records and receipts for maintenance expenses for your vehicle, engine, or hybrid conversion system. You are responsible for presenting your vehicle, engine, and hybrid conversion system to a (applicant's name) dealer or representative as soon as a problem is detected. The warranty repair or replacement should be completed in a reasonable amount of time, not to exceed 30 days. If you have questions regarding your warranty rights and responsibilities, you should contact (Insert manufacturer's chosen contact) at 1-800-xxx-xxxx, or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731, by telephone at (800) 363-7664, or by electronic mail at helpline@arb.ca.gov.”

(d) Warranty Notification.

For all hybrid conversion systems, the manufacturer must notify the hybrid conversion system purchaser or lessee in writing prior to purchase or lease that installation of the hybrid conversion system may affect the base vehicle or engine manufacturer's warranty. Acknowledgement of receipt of this notification must be signed by the purchaser or lessee prior to sale or lease of the hybrid conversion system, must be maintained by the applicant for the duration of the warranty period, and must be supplied by the applicant upon request of the Executive Officer, within ten days of such request.

- (e) Installation Warranty Statement. The authorized installer must furnish the owner with a copy of the following statement.

“YOUR WARRANTY RIGHTS AND OBLIGATIONS
(Authorized installer's name) warrants that the installation of a hybrid conversion system will not prevent the hybrid conversion system from operating as it was designed during the installation warranty period, provided there has been no abuse, neglect, improper maintenance, or improper operation of your hybrid conversion system or vehicle, as specified in the owner's manual. The minimum installation warranty period is 3 three years or 50,000 miles, whichever comes first. The extent of the warranty coverage provided by (authorized installer's name) must be the same as the warranty provided by the product manufacturer, and the same exclusions apply.”

- (f) Hybrid Conversion System Warranty Report.

The applicant must submit a warranty report to the Executive Officer within 30 calendar days if, at any time, the cumulative number of valid warranty claims for the same part or component of the hybrid conversion system in California exceeds one percent of the cumulative California sales or leases for the hybrid conversion system, or ten claims within California, whichever is greater. Where valid warranty claims exceed one percent of California sales, or ten claims within California, whichever is greater, the Executive Officer may deny certification of the hybrid conversion system, or modify, revoke or suspend the existing ARB certification of affected systems. Where valid warranty claims exceed 4 percent of California sales or 25 claims within California, whichever is greater, the Executive Officer may order a recall per the requirements of Section 11 of these procedures, at the Executive Officer's discretion.

The warranty report must include the following information, and must be submitted in the format determined by the Executive Officer:

- (1) The manufacturer's business name, number of California sales for the given calendar year, number of cumulative California sales, number of California leases for the given calendar year, and the number of cumulative California leases of the applicable hybrid conversion system;
- (2) The California production volume for the current and prior calendar year, and the cumulative production volume of the applicable hybrid conversion system (across all calendar years);
- (3) A summary of California warranty claims for the applicable hybrid conversion system in the current and prior calendar year. The summary must include:

- (A) A description of the nature of the claims and of the warranty replacements or repairs provided. The applicant must categorize warranty claims for each hybrid conversion system by the part(s) and component(s) replaced or repaired;
 - (B) The number and percentage of hybrid conversion systems for which a need for a warranty replacement or repair was identified;
 - (C) A short description of the hybrid conversion system part and/or component that was replaced or repaired under warranty and the most likely cause for its failure;
 - (D) For each part and/or component replaced or repaired under warranty, the number of annual and cumulative replacements or repairs of each part or component;
 - (E) Name, physical business address, business e-mail address and business phone number of the end-user that filed the warranty claim and, if applicable, the company name. If personal, not business, information is given, the applicant must identify it as such;
 - (F) The date each warranty claim was filed, and the base engine family or base vehicle test group associated with each claim;
 - (G) The reason(s) for any instances in which warranty service was not provided to a person who filed a warranty claim; and
 - (H) A current list of authorized installers for the hybrid conversion system, and their business contact information.
- (4) An applicant that fails to submit a complete hybrid conversion system warranty report within 30 calendar days for valid warranty claims in excess of four percent for the same part or component, may be subject to civil penalties as specified in state law and regulations; and
- (5) A hybrid conversion system warranty report that does not contain all required information will not be considered complete. A hybrid conversion system warranty report will be considered to be complete as of the date that all required information is submitted.

11. RECALL PROVISIONS

If the Executive Officer determines, after a review of an applicant's warranty report or any other information, that a hybrid conversion system has the potential to experience catastrophic or other safety-related failure due to the same part or component, that a hybrid conversion system has valid warranty claims in excess of 4 percent of California sales, or 25 claims in California, whichever is greater, or that a substantial number of units experience a failure of an operational feature, the Executive Officer may require the manufacturer to submit a recall plan and to conduct a recall.

In the event of a recall, the Executive Officer shall provide notification to the applicant that includes the factual basis for the determination, and will designate a date, at least 60 days from the date of receipt of such notification, by which the applicant must submit a recall plan to ARB for review and approval to address the failures or warrantable condition. Each recall plan must be approved by the Executive Officer in writing. A hybrid conversion system subject to a recall must comply with provisions applicable to an influenced recall pursuant to California Code of Regulations, title 13, sections 2112 through 2121.